REMARKS

First of all, the Examiner is thanked for his time and insight during a telephone conference on September 13, 2007 and October 5, 2007, during which the teachings of the cited references were discussed in relation to the independent claims. During the October 5, 2007, Conference the teachings of RIFT was also discussed.

The Final Office Action dated March 23, 2007 has been carefully considered. By this Amendment, Claims 13, 14, 19, 26, 34, 35, 38, 44, 46, 49, 50, 53, 54 and 55 have been amended. Claims 13–15 and 18–27 and 34–57 are pending. Reconsideration of the application as amended is respectfully requested.

Claim Rejections Under 35 U.S.C. § 112

Claims 46 and 54 have been amended to include the step of: locating the preform on a mold. Claims 46 and 54 satisfy the requirements of 35 U.S.C. § 112, second paragraph.

Claim Rejections Under 35 U.S.C. § 103

Claims 13, 20-22, 25, 27 and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran (U.S. Patent No. 5,116,216) and Lang et al. (U.S. Patent No. 6,406,659).

Claim 14 and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Lang et al. (U.S. Patent No. 6,406,659).

Claim 15 and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Lang et al. (U.S. Patent No. 6,406,659) and White (U.S. Patent No. 5,427,725).

Claim 18 and 37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Palmer et al. (U.S. Patent No. 4,942,013).

Claim 19 and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Lang et al. (U.S. Patent No. 6,406,659) and White (U.S. Patent No. 5,427,725).

Claims 23, 24, 41 and 42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Imanara (U.S. Patent No. 5,364,584).

Claim 26 and 44 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Cochran et al. (U.S. Patent No. 5,116,216) and in further view of Stoeberl (U.S. Patent No. 4,120,632).

Claim 25 and 43 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Lang et al. (U.S. Patent No. 6,406,659).

Claim 27 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of Lang et al. (U.S. Patent No. 6,406,659).

Claim 20-21 and 39-40 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030).

Claim 45 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lang et al. (U.S. Patent No. 6,406,659).

Claim 46, 47, 49, 54, 55 and 57 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lang et al. (U.S. Patent No. 6,406,659).

Claim 48 and 56 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lang et al. (U.S. Patent No. 6,406,659) in view of Cochran et al. (U.S. Patent No. 5,116,216).

Claim 50-53 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lang et al. (U.S. Patent No. 6,406,659) in view of Cochran et al. (U.S. Patent No. 5,116,216).

The 35 U.S.C. § 103(a) rejections are respectfully traversed.

Overview of Patentability

As will be shown below in the detailed analysis of the cited reference and the pending claims, it is respectfully submitted that the present application discloses a number of features that are neither shown by the cited references nor suggested by any combination of cited references, including but not limited to:

- forming a redundant double-bag arrangement in a resin-infusion method;
- forming a redundant double-bag arrangement by sealing both an inner and an outer bag to a mold;
- forming a redundant double-bag arrangement which provides a caul effect with respect to a preform when evacuated;
- forming a redundant double-bag arrangement with a pair of vacuum chambers such that if one of the vacuum chambers fails, the other vacuum chamber substantially maintains vacuum integrity;
- evacuating a pair of vacuum chambers such that an outer vacuum chamber collapses substantially against an inner vacuum chamber;
- evacuating a pair of vacuum chambers such that an inner vacuum chamber collapses substantially against a preform;
- debulking the preform substantially by evacuating the vacuum chambers such that the outer vacuum chamber has a pressure greater than a pressure in the inner vacuum chamber;
- infusing resin into the preform when the vacuum chambers are evacuated such that the inner bag is substantially prevented from relaxing behind a wave front of resin when resin is infused into the preform;

- evacuating the vacuum chambers such that the bags provide a caul effect with respect to the preform;
- evacuating redundant vacuum chambers such that an outer vacuum chamber has a pressure greater than a pressure in an inner vacuum chamber; and
- infusing resin into a preform while substantially maintaining evacuated pressure in the vacuum chambers.

Accordingly, it is respectfully submitted that any method or apparatus for resin infusion that includes any one of these features is patentable. In the pending claims, each of the independent claims includes at least one of these features. As such, it is respectfully submitted that the pending claim set is patentable and in condition for allowance.

Detailed Analysis

Claim 13

Claim 13 recites a method for double vacuum chamber resin infusion. Among other steps, claim 13 states (with reference numerals added):

> sealingly bagging the preform (51) to the mold (50) with an inner bag (62) forming a first vacuum chamber;
> sealingly bagging the inner bag (62) to the mold (50) with an outer bag (64) forming a second vacuum chamber;
> **evacuating the second vacuum chamber with the pressure in the second vacuum chamber being greater than the pressure in the first vacuum chamber;**

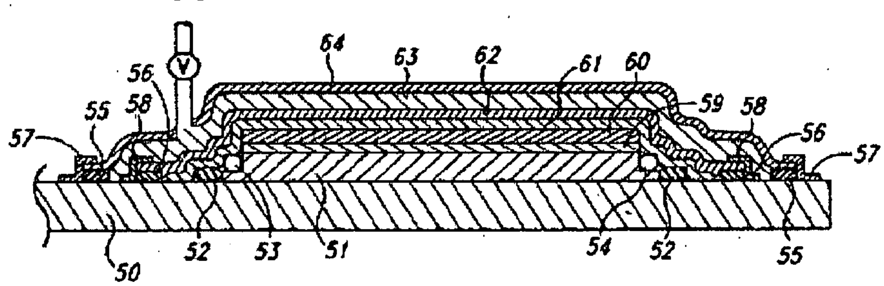


Fig. 2

As can be seen in FIG. 2, the method of claim 13 includes the utilization of two bags (i.e., the inner and outer bags 62 and 64) each of which are sealingly bagged to a mold 50 to form two

vacuum chambers. Then, evacuating the second vacuum chamber with the pressure in the second vacuum chamber being greater than the pressure in the first vacuum chamber.

It is respectfully submitted that Hooper ('030) does not teach or suggest, among other things, the following features of claim 13:

1. sealingly bagging two bags to a mold; and
2. forming two vacuum chambers.
3. evacuating the second vacuum chamber with the pressure in the second vacuum chamber being greater than the pressure in the first vacuum chamber.

The Final Office Action dated August 20, 2007 states on page 2-3:

-Hooper ('030 **teaches the basic claimed process of making a fiber reinforces composite including,** providing a preform laminate (20), placing said preform laminate (20) onto a mold (12), providing a first bag (32) against said mold (12) to form a first chamber, sealing a second bag which is a vacuum bag against said mold (12), **drawing a vacuum onto said first bag and said second bag using port (16), a second port (44),** and infusing resin using port (42) (see col. 4, line 43 through col.5, line 33). (emphasis added).

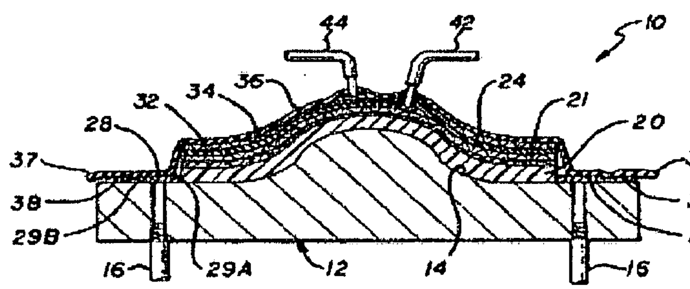


FIG.3

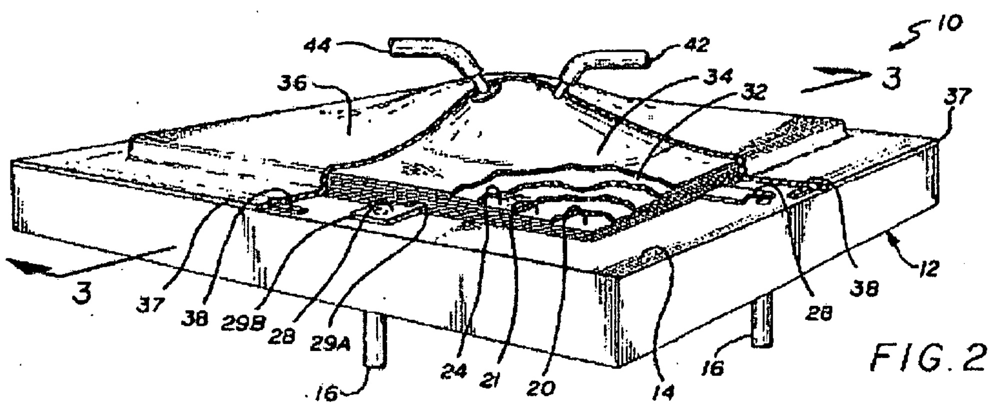


FIG.2

It is respectfully submitted that this characterization of the Hooper patent is erroneous.

As can be seen in FIGS. 2 and 3 from Hooper provided above, impervious flexible sheet (32) does not seal against mold (12) but rather appears to only extend to the edge of the layup (20). Accordingly, impervious flexible sheet (32) does not extend to the mold (12) and does not form a vacuum chamber. Indeed, Hooper confirms the same at col. 5, lines 4-12, by stating that impervious flexible sheet (32) has an area generally equal to the area of the lay-up 20.

Further, as impervious flexible sheet (32) does not seal layup (20) against mold (12), Hooper fails to teach or suggest a first vacuum chamber as recited in claim 13. One skilled in the art can understand that the impervious flexible sheet (32) of Hooper functions as a resin infusion barrier to prevent infused resin from migrating upwards away from layup (20) and into second sheet (34). Indeed, resin is infused through vacuum bag (36) and beneath impervious flexible sheet (32) via resin inlet port 42 and sealing tape (38) (see col. 5, lines 22-26). **Therefore, impervious flexible sheet (32) is a barrier ply and not a bag as used in claim 13. The name, impervious flexible sheet (32), further supports the position that it is a baorrier ply impervious to resin.**

The Final Office Action dated August 20, 2007 further states on page 3:

> -Regarding claims 13 and 34, although Hooper ('030) **teaches a first and a second bags**, Hooper ('030) **does not teach** that the first bag is a vacuum bag and is sealed to the mold, or **that the pressure in the second vacuum chamber is equal to or greater than the pressure in the first vacuum chamber**. (emphasis added).

Again, Hooper teaches an impervious barrier to resin migration away from the preform ply (impervious flexible sheet (32)) and a vacuum bag (32). The impervious flexible sheet (32) can not be categorized as a bag because it is not sealed along it perimeter as Hooper teaches is necessary to form a vacuum bag, for instance vacuum bag (36). Since impervious flexible sheet (32) does not have any type of edge seal and does not extend beyond the edge of the preform, it is a barrier ply not unlike peel ply 21. Peel ply 21 allows resin distribution over and through it (col. 5 lines 47) while impervious flexible sheet (32) allows resin distribution under it only.

Therefore Hooper teaches a ply (32) and a vacuum bag (32) and not "a first and a second bags" as characterized by the Examiner.

Therefore, Hooper has only one vacuum chamber and only one vacuum bag Expanding on the lack of teaching or suggestion of two vacuum chambers, Hooper states that "an impervious sheet 36, generally referred to as 'vacuum bag' is placed over the second sheet 34 and sealed by its marginal edges 37 to the mold surface 14 by means of a sealing tape 38 forming a sealed chamber 40" (see col. 5, lines 17-21). Accordingly, the sealed chamber 40 is the only sealed chamber that Hooper teaches and, as such, Hooper has only one vacuum chamber, not two as recited in claim 13.

The Final Office Action dated August 20, 2007 states on page 3:

> -However, **Lang et al teach a first (185) and second (189) vacuum bags, each sealed to the mold (183)**. (emphasis added).

As Lang teaches "first (185) and second (189) vacuum bags, each sealed to the mold (183)" and as Hooper "does not teach that the first bag is a vacuum bag and is sealed to the mold" and therefore has only one vacuum chamber, Lang is closer prior art than Hooper to the discussion of claim 13.

Claim 13 further recites, amongst other steps:

> evacuating the second vacuum chamber with the pressure in the second vacuum chamber being greater than the pressure in the first vacuum chamber;

The Final Office Action dated August 20, 2007 further states about Lang on page 3:

> -... Lang et al further teach that the vacuum or pressures in the first and second bags are separately manipulated to provide resin flow channels or resin distribution (9:60-10:28) ... Thus, in view of the teaching to manipulate pressure in the two vacuum chambers (7:15-40, 8:38-46, and Claim 1), the particular pressures represent result effective variables that the ordinary artisan would modify, adjust, and optimize in order to provide resin channels or distribution. (emphasis added).

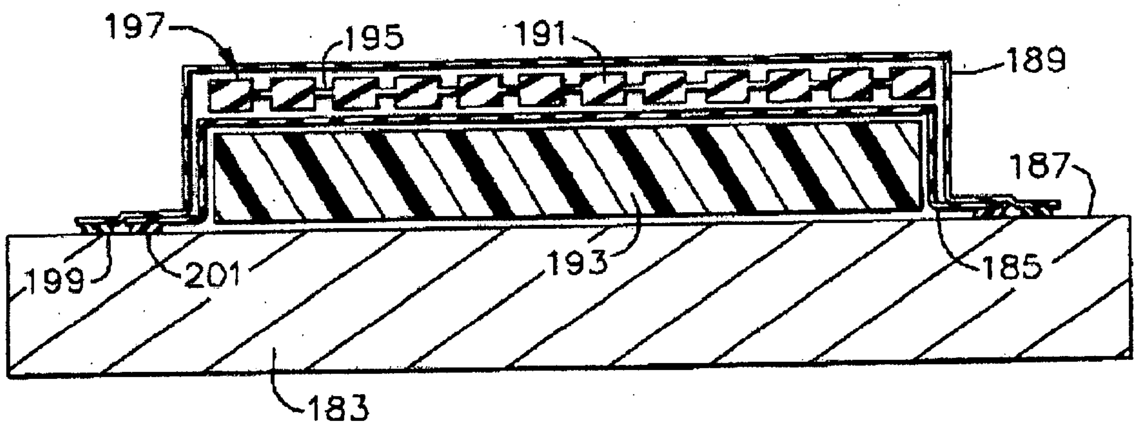


FIG. 8

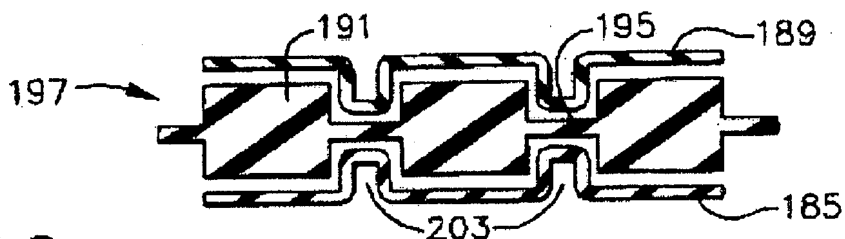


FIG. 10

Lang teaches away from Claim 13 as Lang et al. applies a differential pressure with the greater pressure on the preform side of the inner bag and a lesser pressure on the spacer system, outer bag side, Col. 7, lines 22-27 as follows:

> A resin pressure on the preform side of the flexible mold greater than the pressure in the channels below the surface of the flexible mold causes the flexible mold material between the channels and the preform to deform into the interior channels and thereby create resin distribution channels on the surface of the preform.

Pressures in Lang's inner and the outer bags can be manipulated "… in the two vacuum chambers …" as suggested by the Examiner. "… the particular pressures represent result effective variables that the ordinary artisan would modify, adjust, and optimize in order to provide resin channels or distribution." Pressures within the bags can be manipulated, provided that the pressure in the inner bag remains greater than the pressure in the outer bag.

Every embodiment of Lang relies upon the temporary creation of resin distribution channels to distribute the resin above the preform prior to resin flowing into the preform as stated in Col. 3, lines 46- 54 as follows:

> Though there are many features and embodiments of the present invention, the essence of the invention is a method and the related apparatus for molding a composite by infusing resin into a permeable preform, comprising the creation of temporary resin channels on the surface of the preform, flowing resin along the channels and from the channels into the preform, stopping the flow of resin, removing the temporary channels if desired, curing the resin in the preform and forming a composite.

If the differential pressure of Claim 13 is applied to Lang, namely that a lesser pressure is applied to the preform side of the inner bag and a greater pressure on the spacer system between the inner and outer bag, then resin distribution channels 203 of Fig 10 above cannot be formed. If the pressure distribution of Claim 13 is applied to Lang the inner bag would not collapse against the individual spacer 191 as shown in Figure 10 and therefore no resin distribution channels 203 would be formed. There would be no means to channel the resin above the preform as taught by Lang and at best a poor quality infusion would occur.

The Final Office Action dated August 20, 2007 still further states about Lang on page 3:

> Additionally, Lang et al teach that in at least one embodiment, it is desirable to maintain a vacuum on both sides of the flexible membrane such that the flexible membrane does not deform (5:44-46) such that the resin presses the flexible membrane open to create channels (5:52-56). In maintaining a vacuum on both sides of a flexible membrane such that the membrane does not deform, it would have been obvious to use a second vacuum pressure equal to the first vacuum pressure during resin injection in order to avoid deformation of the first flexible membrane.

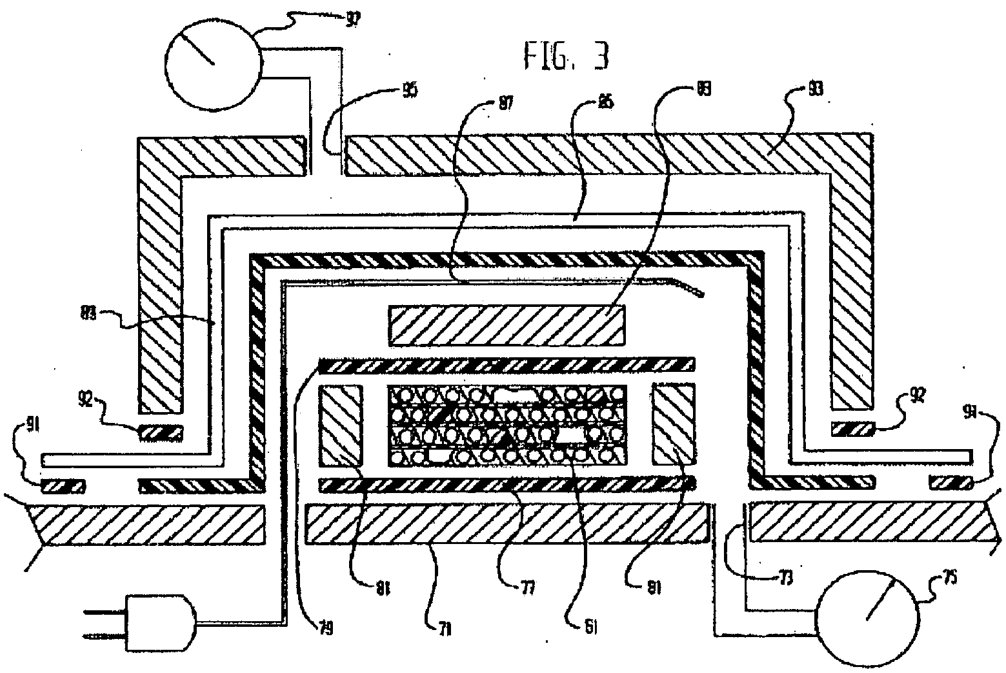
Lang also teaches away from Claim 13 when Lang et al. applies equal pressure in both vacuum chambers in this one embodiment as noted by the Examiner. If a greater pressure is applied to the outer vacuum chamber in Lang, the greater pressure will prevent the "creating temporary resin distribution pathways on the surface of the preform" (3:39-40), by resin pressing against the membrane or pushing the inner bag between individual spacer 191 and against inter-connecting link 195 (Lang- Fig. 10 above). If a greater pressure exists in the outer vacuum

chamber, Lang cannot form resin distribution channels or pathways and there will be no means to distribute resin over the surface of the preform.

The Final Office Action dated August 20, 2007 states about Cochran on page 4:

-... Cochran et al ('216) teach a resin **impregnation** process including, providing a fibrous prepreg (61), placing said **prepreg (61)** onto a mold (71), sealing a first vacuum bag (89) against said mold (12) to form a first vacuum chamber, **sealing a vacuum cover (93) to form a second vacuum chamber**, drawing a vacuum onto said first chamber and onto said second vacuum chamber **such that the pressure within said second chamber is higher than the pressure within said first vacuum chamber** and **impregnating fibrous pre-preg** by **applying heat** (see col. 5, line 60 through col. 6, line 11 and figure 3). (emphasis added).

FIG. 3



It is respectfully submitted that this characterization of the Cochran patent is erroneous.

Vacuum cover (93) is sealed to vacuum bag (89) to form a second vacuum chamber. Vacuum cover (93) is not sealed to mold (71). **Therefore, there is only one vacuum chamber chamber sealed to the mold unlike claim 13.**

The preform of Cochran is impregnated with resin prior to being placed between flexible bag 89 and steel base plate 71. By definition, a prepreg has already been impregnated, also called preimpregnated, with resin. **Indeed, Cochran does not disclose or teach a means for resin infusion of the preform, let alone resin infusion of a preform after it is placed in a subsequently evacuated vacuum chamber.** Claim 13 a dry preform into a vacuum chamber which is then evacuated prior to resin infusion. This distinction between impregnating a dry preform while in an evacuated vacuum chamber and placing an impregnated preform into a mold goes to the most fundamental distinction between composites.

Cochran also uses a hard inflexible vacuum cover (93) and a steel base plate 71 to sandwich the prepreg, which is different from the bags used to form vacuum chambers in claim 13.

The application of heat in Cochran does not "impregnate said fibrous pre-preg" as asserted by the Examiner. Again, the prepreg is pre-impregnated. The application of a vacuum along with the application of high heat removes voids between the plies, trapped gases and other volatiles from the prepreg and melts the pre-impregnated plies together (see col. 4, line 46-47 and col. 5, line 60 through col. 6, line 14 and figure 3). Removing trapped gases and other volatiles from the prepreg and raising the temperature to above the melting temperature of the resin further distinguishes Cochran from Claim 13. Indeed, Lang teaches that "the resins may be catalyzed for high temperature cure or room temperature cure and for various cures times as is compatible with the needs of the molding process. The resin should be properly catalyzed and **degassed** prior to injection into the preform cavity. The wide variety of useful resins and the methods of preparing the resin are all widely known in the art." (Col 3, lines 3-6). The resin infused in Claim 13 is in a liquid state prior to being "catalyzed" during the application of heat and pressure. Lang also teaches that resins are "degassed prior to injection into the preform cavity", so removing trapped gases and other volatiles occurs prior to resin injection and not from a prepreg within in a mold. **Lang uses an entirely different type of resin than Cochran. The Cochran resin is not compatible with the Lang type of resin infusion.** As the resin of Claim 13 is in liquid form prior to and during injection, no melting of the "pre-impregnated plies

together" needs to occur to make the resin flow. Therefore, Cochran teaches placing a preform in a mold with a higher second chamber pressure than the pressure within the first vacuum chamber under high heat to melt prepreg plies together and remove trapped gases and other volatiles neither of which occurs in Claim 13. The teachings of Cochran are not applicable to the method of Claim 13.

Cochran is not analogous art to Claim 13 **as it teaches a method of curing preimpregnated material within hard tooling and not a method of resin impregnation of a dry preform under vacuum** and one of ordinary skill in the art would not combine Cochran with Lang.

Again, Lang will not function if the pressures in Lang are modified as suggested by Cochran "... such that the pressure within said second chamber is higher than the pressure within said first vacuum chamber ...". The temporary resin distribution channels, such as resin distribution channels 203, will not be formed and there will be no means for distributing the resin prior to infusion into the preform.

Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion on how to combine or modify the references, with the combination or modification being sufficient to render Claim 13 obvious to one of ordinary skill in the art. Therefore, it is respectfully submitted that Claim 13 is patentable over the Hooper, Lang and Cochran patents and is in a condition for allowance.

In the paper titled: **Resin Infusion Under Flexible Tooling (RIFT): a review**, here after referred to as RIFT, an embodiment "using a double vacuum bag" is disclosed on page 519. "DSM have also introduced a method using a double vacuum bag. Low vacuum (0.1) is initially applied to the inner bag to lightly compress the reinforcement. At this stage the fabric is manually pressed into corners of the mould. Vacuum is then raised to 0.5 bar after which the outer bag is put in place. An even distribution of vacuum has to be achieved between the films: a breather layer (synthetic tissue is used so that the resin front can be seen) is laid between each

film. Vacuum between the films is then increased to 0.96 bar (gauge pressure). The increase in vacuum pressure between the films removes the danger of air into the tool through the bag. During laminate filling the inner vacuum is turned off, with resin inlets and outlets plugged. The outer bag vacuum is maintained in order to consolidate the laminate until the resin has cured."

In RIFT, the vacuum in the inner vacuum chamber reaches a maximum of 0.5 bar while the vacuum in the outer bag reaches a pressure of 0.96 bar. **Therefore RIFT has almost twice as much pressure in the inner chamber as in the outer chamber, which is not unlike Lang. A higher pressure in the inner chamber of RIFT is the opposite of the method of Claim 13, which has a higher pressure in the outer vacuum chamber.**

Claims 14, 15, and 18–27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hooper (U.S. Patent No. 5,576,030) in view of various combinations of Cochran et al. (U.S. Patent No. 5,116,216), Lang et al. (U.S. Patent No. 6,406,659), White (U.S. Patent No. 5,427,725), Palmer et al. (U.S. Patent No. 4,942,013), Imanara (U.S. Patent No. 5,364,584), and Stoeberl (U.S. Patent No. 4,120,632). Each of these claims depends from Claim 13. For reasons analogous to those presented above in relation to Claim 13, it is respectfully submitted that each of the cited references, either alone or in combination, fails to teach or suggest the respective methods of Claims 14, 15, and 18–27.

Claim 34

Claim 34 recites a method for double vacuum chamber resin infusion. Among other steps, Claim 34 states (with reference numerals added):

> bagging the preform (51) to the mold (50) with an inner bag (62) forming a first vacuum chamber;
> bagging the inner bag (62) to the mold (50) with an outer bag (64) forming a second vacuum chamber;
> evacuating the first vacuum chamber such that the first vacuum chamber collapses substantially against the preform;

evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber;

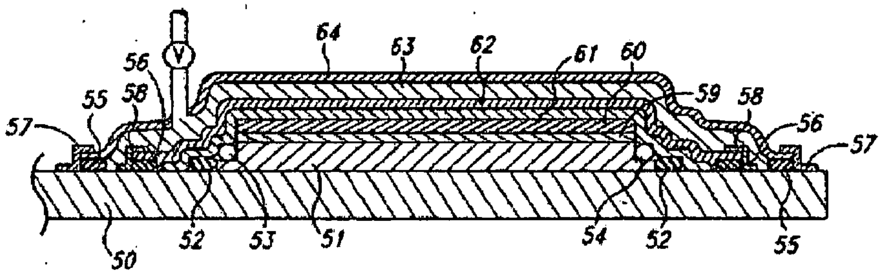


Fig. 2

The Hooper patent is discussed above. In contrast to Claim 34, Hooper does not teach or suggest bagging with inner and outer bags to form first and second vacuum chambers. Accordingly, it is not possible for Hooper to evacuate the first and second vacuum chambers as recited in Claim 34.

The Final Office Action dated August 20, 2007 further states about Lang on page 3:

> -... Lang et al further teach that the vacuum or pressures in the first and second bags are separately manipulated to provide resin flow channels or resin distribution (9:60-10:28), and doing so **substantially collapses the second vacuum chamber against the first vacuum chamber** (Fig 10). (emphasis added).

It is respectfully submitted that this characterization of the Lang patent is erroneous.

Lang et al "... positions a spacer system (191) onto said inner bag, placing an outer vacuum bag (189) onto said spacer system (191) to form a second vacuum chamber..." as stated by the Examiner in the office action dated July 11, 2006 and shown in Figures 9-12 of Lang et al. (Figure 10 above). **Figure 10 shows an individual spacer 191 and an inter-connecting link 195 located between outer bag 189 and inner bag 185. The spacer system (191) prevents the second vacuum chamber from collapsing substantially against the first vacuum chamber.**

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Art Unit 1732

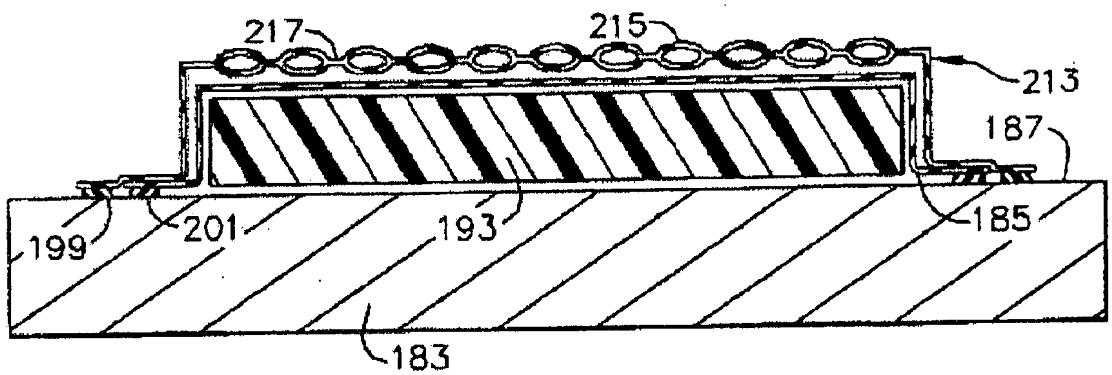


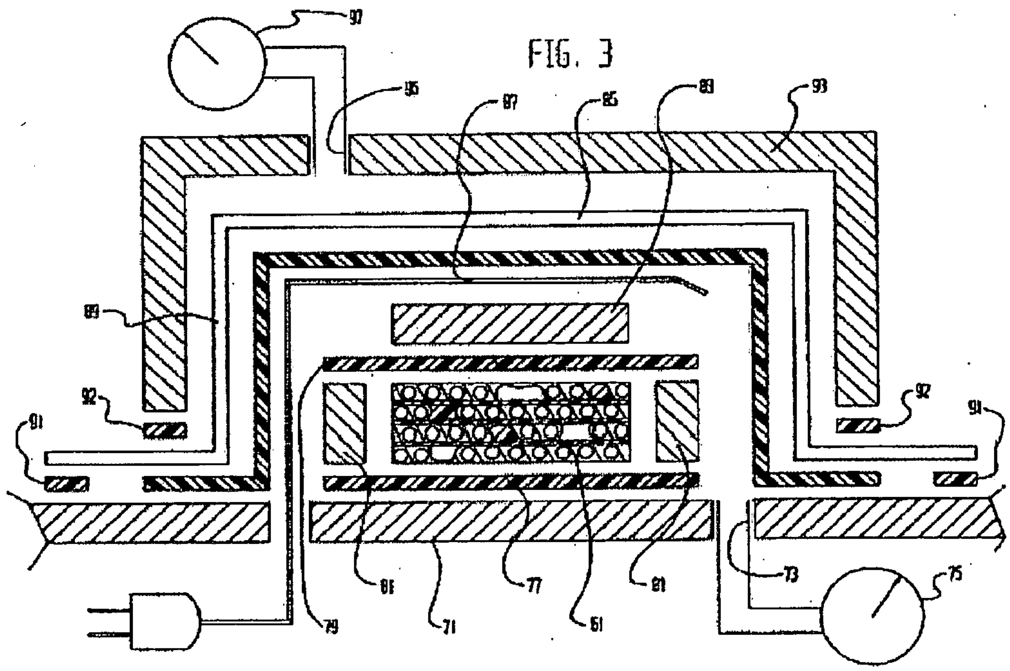
FIG. 13

Lang states, "FIG. 13 shows the apparatus of FIG. 8 except the spacer system 197 and outer flexible membrane 189 are replaced with a bubble mat 213. The bubble mat is similar to that used as padding when shipping delicate items. ... **The flexible membrane 185 is deformed into the space between the bubbles to create temporary resin distribution channels.**" (9:11-19)

When evacuated according to Lang, 185 deforms into the space between the bubbles to from channels or pathways and therefore relaxes away from the preform. The relaxed 185 cannot substantially collapse against the preform. Lang et al. fails to anticipate Claim 34.

Cochran et al. also fails to teach or suggest "evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber". Cochran has a first vacuum bag (89) sealed against the mold (12) to form a first vacuum chamber, but has a rigid vacuum cover (93) sealed against first vacuum bag (89) to form a second vacuum chamber. Vacuum cover (93) is not sealed against mold (12), but instead is sealed against first vacuum bag (89). Also, the vacuum cover (93) is rigid and cannot collapse against the first vacuum bag (89), so evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber is impossible.

Serial No. 09/731,945
Art Unit 1732



On page 519 of RIFT, an embodiment "using a double vacuum bag" is disclosed. "DSM have also introduced a method using a double vacuum bag. Low vacuum (0.1) is initially applied to the inner bag to lightly compress the reinforcement. At this stage the fabric is manually pressed into corners of the mould. Vacuum is then raised to 0.5 bar after which the outer bag is put in place. An even distribution of vacuum has to be achieved between the films: a breather layer (synthetic tissue is used so that the resin front can be seen) is laid between each film. Vacuum between the films is then increased to 0.96 bar (gauge pressure). The increase in vacuum pressure between the films removes the danger of air into the tool through the bag. During laminate filling the inner vacuum is turned off, with resin inlets and outlets plugged. The outer bag vacuum is maintained in order to consolidate the laminate until the resin has cured."

In RIFT, the vacuum in the inner vacuum chamber reaches a maximum of 0.5 bar while the vacuum in the outer bag reaches a pressure of 0.96 bar. The inner vacuum bag will be pushed up towards the outer vacuum bag by the higher pressure in the inner vacuum chamber. This situation is similar to what is shown in Lang in Fig. 10. The pushing of the inner bag away

from the preform is also known as bag relaxation. The method of evacuating the inner bag to 0.5 bar prior to evacuating the outer bag shows that the user of the RIFT method recognizes that any other order would not result in any preform consolidation prior to resin infusion. **Therefore, as RIFT has almost twice as much pressure in the inner chamber as in the outer chamber, the inner bag cannot substantially collapse against the preform when the outer bag is evacuated.**

RIFT also states that, "an even distribution of vacuum has to be achieved between the films: a breather layer (synthetic tissue is used so that the resin front can be seen) is laid between each film." Therefore, RIFT places a breather layer between the inner and the outer vacuum bags. This breather layer prevents evacuating the second vacuum chamber such that the second vacuum chamber collapses substantially against the first vacuum chamber as stated in claim 34.

Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion on how to combine or modify the references, with the combination or modification being sufficient to render the method of Claim 34 obvious to one of ordinary skill in the art. Therefore, it is respectfully submitted that Claim 34 is patentable over Hooper, Lang and Cochran patents and RIFT and is in a condition for allowance.

Claims 35-45 depend from Claim 34. For reasons analogous to those presented above in relation to Claim 34, it is respectfully submitted that each of the cited references, either alone or in combination, fails to teach or suggest the respective methods of Claims 35-45.

Claim 46

Claim 46 recites a method for infusing with resin a preform disposed on a mold. Among other steps, Claim 46 states:

evacuating the vacuum chambers such that the outer vacuum chamber has a pressure greater than a pressure in the inner vacuum chamber such that the **inner bag is substantially**

prevented from relaxing behind a wave front of resin when resin is infused into the perform; and

infusing resin into the preform while substantially maintaining the pressures in the vacuum chambers.

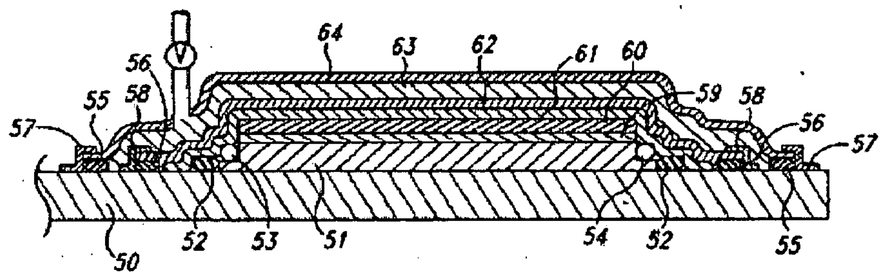


Fig. 2

Support for the amendment to Claim 46 can be found in the specification and in the following exemplary passage, but support relied upon is not limited to this section:

> [0011] Our preferred double bag vacuum infusion process circumvents the Seemann (single bag) problems in that the inner and outer vacuum bags independently control the resin feed. .... With this approach, **the bag is never able to relax behind the wave front** and the resulting composites have higher fiber volumes on average (with more precise control) and have uniform thickness with constant thickness preforms. ....

The Final Office Action dated August 20, 2007 states about Lang on page 10:

-Lang teaches a method for infusing a preform with resin disposed on a mold, the method comprising:

Forming a redundant double-bag arrangement by:
Disposing an inner bag over the preform (FIG. 8, items 193 and 185);
Sealing the inner bag to the mold to form an inner vacuum chamber defined by the inner bag and mold (Fig. 8);
Disposing an outer bag over the inner bag (Fig.8, item 189); and
Sealing the outer bag to the mold to form an outer vacuum chamber defined by the outer bag, the inner bag, and the mold (Fig. 8);
Evacuating the vacuum chamber and inner vacuum chamber and infusing resin into the preform while substantially maintaining the pressures in the vacuum chambers (10:7-10, 5:33-64).

> -... Lang et al further teach that the vacuum or pressures in the first and second bags are separately manipulated to provide resin flow channels or resin distribution (9:60-10:28), and doing so **substantially collapses the second vacuum chamber against the first vacuum chamber** (Fig 10). (emphasis added).
>
> Additionally, Lang et al teach that in at least one embodiment, it is desirable to maintain a vacuum on both sides of the flexible membrane such that the flexible membrane does not deform (5:44-46) such that the resin presses the flexible membrane open to create channels (5:52-56). In maintaining a vacuum on both sides of a flexible membrane such that the membrane does not deform, it would have been **obvious to use a second vacuum pressure equal to the first vacuum pressure during resin injection** in order to avoid deformation of the first flexible membrane. (emphasis added).

Yet again it is respectfully submitted that this characterization of the Lang patent is erroneous.

Lang et al "... positions a spacer system (191) onto said inner bag, placing an outer vacuum bag (189) onto said spacer system (191) to form a second vacuum chamber..." as stated by the Examiner in the office action dated July 11, 2006 and shown in Figures 9-12 of Lang et al. (Figure 10 above). Figure 10 shows an individual spacer 191 and an inter-connecting link 195 located between outer bag 189 and inner bag 185. **The spacer system (191) prevents the second vacuum chamber from collapsing substantially against the first vacuum chamber.**

Lang also teaches away from Claim 46 when Lang et al. applies equal pressure in both vacuum chambers in this one embodiment as noted by the Examiner. If a greater pressure is applied to the outer vacuum chamber in Lang, resin distribution channels will prevent the "creating temporary resin distribution pathways on the surface of the preform" (3:39-40), by resin pressing against the membrâne or higher pressure in the inner vacuum chamber pushing the inner bag between individual spacer 191 and against inter-connecting link 195 (Lang- Fig. 10 above). If a greater pressure exists in the outer vacuum chamber, Lang cannot form resin distribution channels or pathways and there will be no means to distribute resin over the surface of the preform.

Lang relies upon inner bag relaxation to help form channels or pathways to distribute the resin over the surface of the preform. Either the scenario with greater pressure

in the inner bag or equal pressure in both bags results in inner vacuum bag relaxation to form channels or pathways to distribute the resin over the surface of the preform as shown in figure 10. **Bag relaxation is contrary to the teaching to substantially prevent the inner bag from relaxing behind a wave front of resin when resin is infused into the preform.** In paragraph 10, Waldrop states, "we have observed that the composite in areas where the bag has relaxed can have lower fiber volume, poor fiber volume control, and lower mechanical properties than desired, because excess resin has filled the enlarged volume. The bag relaxation can produce a change in the intended thickness of the composite, so that in localized areas where relaxation has occurred the composite is thicker than intended."

Bag relaxation may lead to mark off on the surface of the cured preform which is contrary to the teaching of Waldrop. In paragraph 17, Waldrop states, "bag side roughness and mark off is a common problem experienced with prepreg processing and bag liquid molding processes. Cauls and intensifiers are often used on the bag side of the laminate to improve surface finish."

On page 519 of RIFT, an embodiment "using a double vacuum bag" is disclosed. "DSM have also introduced a method using a double vacuum bag. Low vacuum (0.1) is initially applied to the inner bag to lightly compress the reinforcement. At this stage the fabric is manually pressed into corners of the mould. Vacuum is then raised to 0.5 bar after which the outer bag is put in place. An even distribution of vacuum has to be achieved between the films: a breather layer (synthetic tissue is used so that the resin front can be seen) is laid between each film. Vacuum between the films is then increased to 0.96 bar (gauge pressure). The increase in vacuum pressure between the films removes the danger of air into the tool through the bag. During laminate filling the inner vacuum is turned off, with resin inlets and outlets plugged. The outer bag vacuum is maintained in order to consolidate the laminate until the resin has cured."

In RIFT, the vacuum in the inner vacuum chamber reaches a maximum of 0.5 bar while the vacuum in the outer bag reaches a pressure of 0.96 bar. **Therefore the pressure in the inner bag is greater than the pressure in the outer bag.** The inner vacuum bag will be pushed up towards the outer vacuum bag by the higher pressure in the inner vacuum chamber. This

situation is similar to what is shown in Lang in Fig. 10. The pushing of the inner bag away from the preform is known as bag relaxation. **When RIFT evacuates the outer chamber to 0.96 bar and then infuses resin, the combination of the greater pressure in the inner bag and the resin wave front during infusion pushes against the inner bag away from the preform a condition caller bag relaxation resulting in undesirable higher resin volume in the final product.**

RIFT does not describe evacuating the vacuum chambers such that the outer vacuum chamber has a pressure greater than a pressure in the inner vacuum chamber such that the inner bag is substantially prevented from relaxing behind a wave front of resin when resin is infused into the perform as stated in claim 46.

Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion on how to combine or modify the references, with the combination or modification being sufficient to render the method of Claim 46 obvious to one of ordinary skill.

<u>Claim 50</u>

Claim 50 recites a method for infusing with resin a preform disposed on a mold. Among other steps, Claim 50 states:

> **forming redundant vacuum chambers about the perform** such that: ...;
> **debulking the preform substantially** by **evacuating the vacuum chambers such that the outer vacuum chamber has a pressure greater than a pressure in the inner vacuum chamber;**
> **if one of the vacuum chambers fails, the other vacuum chamber maintains the preform substantially debulked by maintaining vacuum integrity;**

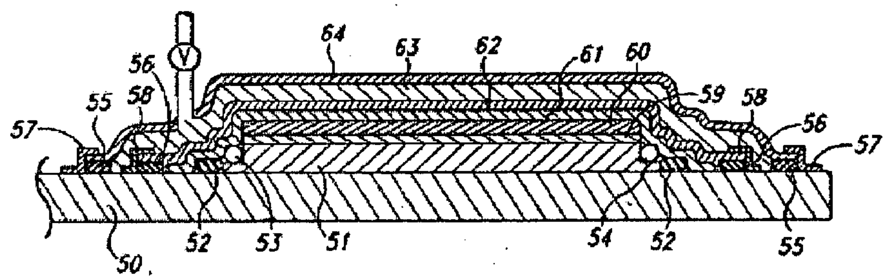


Fig. 2

As can be seen in FIG. 2, the method of claim 50 includes the utilization of two bags (i.e., the inner and outer bags 62 and 64) each of which are sealingly bagged to a mold 50 to form two vacuum chambers.

It is respectfully submitted that Lang et al. (U.S. Patent No. 6,406,659) in view of Cochran et al. (U.S. Patent No. 5,116,216). does not teach or suggest, among other things, the following features of claim 50:

1. forming redundant vacuum chambers about the perform such that: ...
2. debulking the preform substantially by evacuating the vacuum chambers such that the outer vacuum chamber has a pressure greater than a pressure in the inner vacuum chamber;
3. if one of the vacuum chambers fails, the other vacuum chamber maintains the preform substantially debulked by maintaining vacuum integrity.

The Final Office Action dated August 20, 2007 states on page 14:

-Lang teaches a method for infusing a preform with resin disposed on a mold, the method comprising:
Forming a redundant double-bag arrangement by:
Evacuating the vacuum chamber and inner vacuum chamber and infusing resin into the preform while substantially maintaining the pressures in the vacuum chambers (10:7-10, 5:33-64).

Lang does not specifically teach (a) if one of the vacuum chambers fails, the other maintains vacuum integrity, and (b) the evacuation of the vacuum chambers such that the outer chamber has a pressure approximately equal to or greater than a pressure in the inner vacuum chamber.

However, these aspects of the invention would have been prima facie obvious for the following reasons:

(a) Cochran teaches first and second chambers that are individually pumped by first and second vacuums (5:22-24). In the combination of Lang, which provides first and second vacuum chambers, and Cochran, which provides independent pumping using a first and second vacuum chambers, the double bag arrangement of Lang would maintain vacuum integrity in the case of failure of one vacuum chamber.

(b) Lang teaches that the vacuum or pressures in the first and second bags are separately manipulated to provide resin flow channels or resin distribution (9:60-10:28), and doing so substantially collapses the second vacuum chamber against the first vacuum chamber (Fig.10), resulting in resin flow channels (203). Thus, in view of the teaching to manipulate pressure in the two vacuum chambers (7:15-40, 8:38-46, and Claim 1), **the particular pressures represent result effective variables that the ordinary artisan would modify, adjust, and optimize in order to provide resin channels or distribution.** Additionally, Lang teaches that in at least one embodiment, it is desirable to maintain a vacuum on both sides of the flexible membrane such that the flexible membrane does not deform (5:44-46) such that the resin presses the flexible membrane open to create channels (5:52-56). In maintaining a vacuum on both sides of a flexible membrane such the membrane does not deform, it would have been obvious to use a second vacuum pressure equal to the first vacuum pressure during resin injection in order to avoid deformation of the first flexible membrane.

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Cochran into that of Lang because Lang clearly suggests the ability to adjust the vacuum levels in the two chambers separately, which the first and second vacuum of Cochran would provide.

(emphasis added).

Claim 50 further recites, amongst other steps:

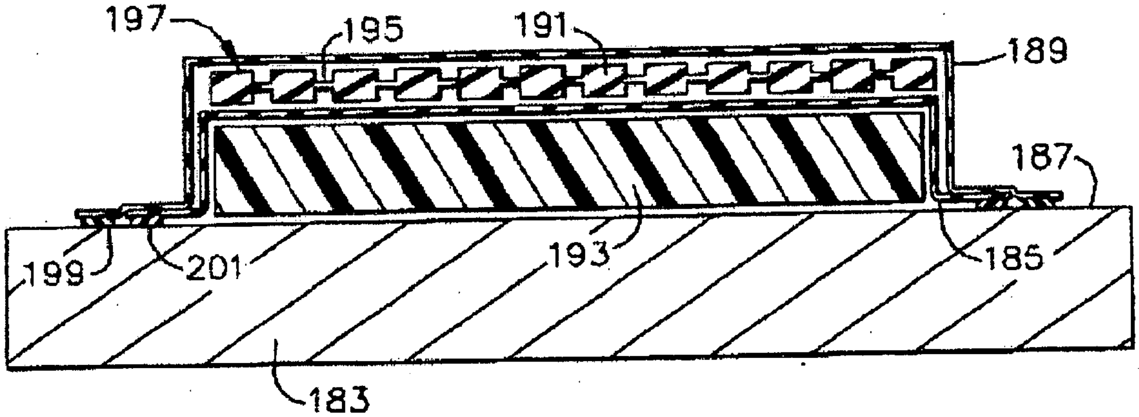


FIG. 8

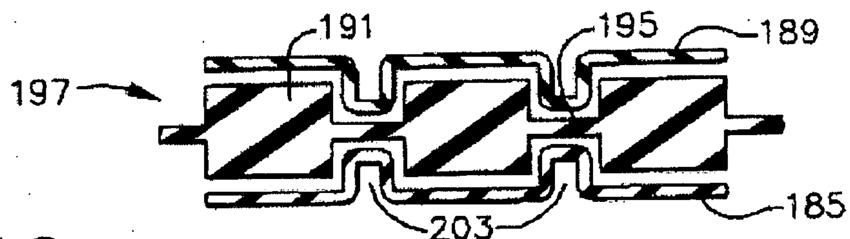


FIG. 10

Lang teaches away from Claim 50 as Lang et al. applies a differential pressure with the greater pressure on the preform side of the inner bag and a lesser pressure on the spacer system, outer bag side, Col. 7, lines 22-27 as follows:

> A resin pressure on the preform side of the flexible mold greater than the pressure in the channels below the surface of the flexible mold causes the flexible mold material between the channels and the preform to deform into the interior channels and thereby create resin distribution channels on the surface of the preform.

Yet again it is respectfully submitted that this characterization of the Lang patent is erroneous.

Lang et al "... positions a spacer system (191) onto said inner bag, placing an outer vacuum bag (189) onto said spacer system (191) to form a second vacuum chamber..." as stated by the Examiner in the office action dated July 11, 2006 and shown in Figures 9-12 of Lang et al.

(Figure 10 above). During evacuation of both the inner and the outer vacuum chambers, a higher pressure in the inner vacuum chamber presses the inner bag against spacer system (191) and away from the preform. The preform may reach a state of being less than substantially debulked as the inner chamber pressure is higher than that of the outer chamber. The inner bag forms channels or pathways for the resin to move across the top of the preform during resin infusion. Pushing the inner bag away from the preform to form channels for resin movement on top of the preform is bag relaxation away from the preform. Once the Lang inner bag relaxes, the preform will begin to swell. The preform will swell even more in Lang as the relaxed bag channels resin into the preform. Any preform swelling increases preform size away from its most debulked state. Bag relaxation prevents the preform from being substantially debulked and remaining substantially debulked during resin infusion.

Lang does not outer vacuum chamber with a pressure greater than a pressure in the inner vacuum chamber, indeed the opposite is the case. Therefore, Lang does not reach the substantially debulking the preform, nor can Lang maintain the preform as substantially debulked during resin infusion.

The Examiner notes that the resin itself also pushes the inner bag away from the preform when he states that "the resin presses the flexible membrane open to create channels (5:52-56). In maintaining a vacuum on both sides of a flexible membrane such that the membrane does not deform, it would have been **obvious to use a second vacuum pressure equal to the first vacuum pressure during resin injection ..." If the resin can push the inner bag away from the preform to form resin channels when the pressure in both bags are equal, the resin can certainly push the inner bag away from the preform when the higher inner chamber pressure helps the pushing by pushing the inner bag into channels against 191 as explained in the paragraph above. When the** resin wave front pushes the inner bag away from the preform during resin infusion, it creates bag relaxation. Once the Lang inner bag relaxes, the preform will begin to swell. The preform will swell even more in Lang as the relaxed bag channels resin into the preform. Any preform swelling increases preform size away from its most debulked state. Bag relaxation prevents the preform from being substantially debulked and remaining substantially debulked during resin infusion.

Lang also teaches away from Claim 50 when Lang et al. applies equal pressure in both vacuum chambers. When the resin wave front pushes the inner bag away from the preform during resin infusion, it creates bag relaxation. Once the Lang inner bag relaxes, the preform will begin to swell. The preform will swell even more in Lang as the relaxed bag channels resin into the preform. Any preform swelling increases preform size away from its most debulked state. Bag relaxation prevents the preform from being substantially debulked and remaining substantially debulked during resin infusion.

If a greater pressure is applied to the outer vacuum chamber in Lang, resin distribution channels will prevent the "creating temporary resin distribution pathways on the surface of the preform" (3:39-40), by resin pressing against the membrane or higher pressure in the inner vacuum chamber pushing the inner bag between individual spacer 191 and against inter-connecting link 195 (Lang- Fig. 10 above).

If the differential pressure of Claim 50 is applied to Lang, namely that a lesser pressure is applied to the preform side of the inner bag and a greater pressure on the spacer system between the inner and outer bag or if both pressures are equal, then resin distribution channels 203 of Fig 10 over the surface of the preform cannot be formed.

The Final Office Action dated August 20, 2007 states about Cochran on page 4:

> -... Cochran et al ('216) teach a resin **impregnation** process including, providing a fibrous prepreg (61), placing said **prepreg (61)** onto a mold (71), sealing a first vacuum bag (89) against said mold (12) to form a first vacuum chamber, **sealing a vacuum cover (93) to form a second vacuum chamber**, drawing a vacuum onto said first chamber and onto said second vacuum chamber **such that the pressure within said second chamber is higher than the pressure within said first vacuum chamber** and **impregnating fibrous pre-preg** by **applying heat** (see col. 5, line 60 through col. 6, line 11 and figure 3). (emphasis added).

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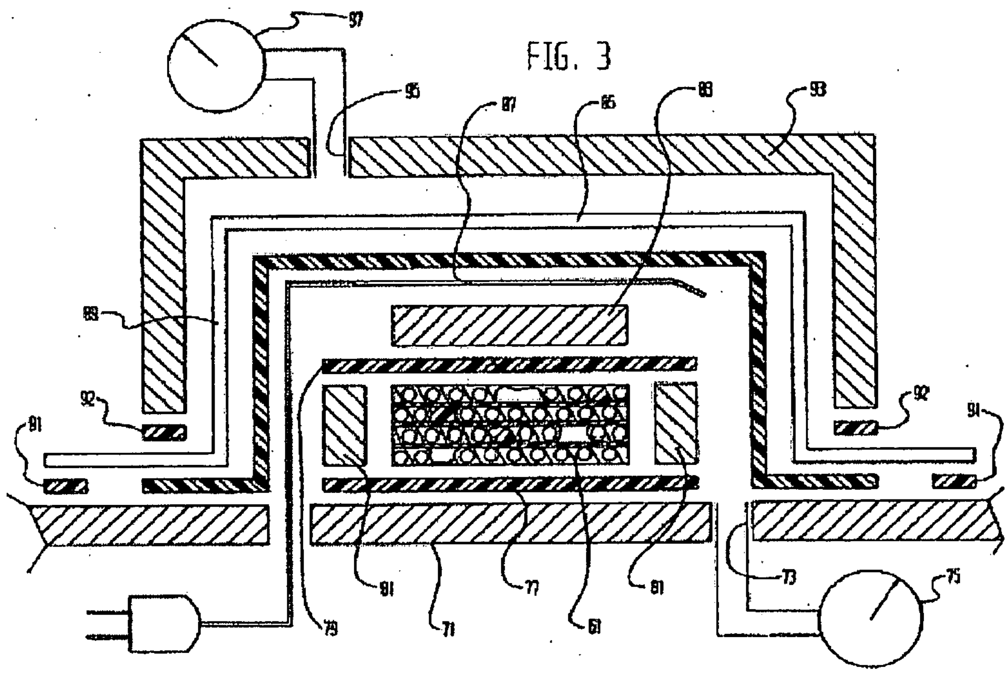
FIG. 3



It is respectfully submitted that this characterization of the Cochran patent is erroneous.

Vacuum cover (93) is sealed to vacuum bag (89) to form a second vacuum chamber. Vacuum cover (93) is not sealed to mold (71).

By definition, a prepreg has already been impregnated with resin. Indeed, the preform of Cochran is impregnated with resin prior to being placed between flexible bag 89 and steel base plate 71. Cochran does not disclose or teach a means for resin infusion of the preform, let alone resin infusion of a preform after it is placed in a mold. Claim 50 infuses resin into a dry preform after it is placed into the mold. This distinction between impregnating a dry preform while in a mold and placing an impregnated preform into a mold goes to the most fundamental distinction between composites.

The application of heat in Cochran does not "impregnate said fibrous pre-preg" as asserted by the Examiner. Again, the prepreg is pre-impregnated. The application of a vacuum along with the application of high heat removes voids between the plies, trapped gases

and other volatiles from the prepreg and melts the pre-impregnated plies together (see col. 4, line 46-47 and col. 5, line 60 through col. 6, line 14 and figure 3). Removing trapped gases and other volatiles from the prepreg and raising the temperature to above the melting temperature of the resin further distinguishes Cochran from Claim 50. Indeed, Lang teaches that "the resins may be catalyzed for high temperature cure or room temperature cure and for various cures times as is compatible with the needs of the molding process. The resin should be properly catalyzed and **degassed** prior to injection into the preform cavity. The wide variety of useful resins and the methods of preparing the resin are all widely known in the art." (Col 3, lines 3-6). The resin infused in Claim 50 is in a liquid state prior to being "catalyzed" during the application of heat and pressure. Lang also teaches that resins are "degassed prior to injection into the preform cavity", so removing trapped gases and other volatiles occurs prior to resin injection and not from a prepreg within in a mold. As the resin of Claim 50 is in liquid form prior to and during injection, no melting of the "pre-impregnated plies together" needs to occur to make the resin flow. Therefore, Cochran teaches placing a preform in a mold with a higher second chamber pressure than the pressure within the first vacuum chamber under high heat to melt prepreg plies together and remove trapped gases and other volatiles neither of which occurs in Claim 50. The teachings of Cochran are not applicable to the method of Claim 50.

Cochran is not analogous art to Claim 50 and one of ordinary skill in the art would not combine Cochran with Lang.

Even so, Lang will not function if the pressures are modified as suggested by the method of Cochran "... such that the pressure within said second chamber is higher than the pressure within said first vacuum chamber ...". The temporary resin distribution channels, such as resin distribution channels 203, will not be formed and there will be no means for distributing the resin prior to infusion into the preform. The Modified Lang preform will have poor resin impregnation at best with areas of over saturation, areas of resin starvation, porosity, voids and areas of low fiber volume. Also spacer system (191) of Lang would serve no purpose when the method of Cochran is used on Lang.

On page 519 of RIFT, an embodiment "using a double vacuum bag" is disclosed. "DSM have also introduced a method using a double vacuum bag. "DSM have also introduced a method using a double vacuum bag. Low vacuum (0.1) is initially applied to the inner bag to lightly compress the reinforcement. At this stage the fabric is manually pressed into corners of the mould. Vacuum is then raised to 0.5 bar after which the outer bag is put in place. An even distribution of vacuum has to be achieved between the films: a breather layer (synthetic tissue is used so that the resin front can be seen) is laid between each film. Vacuum between the films is then increased to 0.96 bar (gauge pressure). The increase in vacuum pressure between the films removes the danger of air into the tool through the bag. During laminate filling the inner vacuum is turned off, with resin inlets and outlets plugged. The outer bag vacuum is maintained in order to consolidate the laminate until the resin has cured."

In RIFT, the vacuum in the inner vacuum chamber reaches a maximum of 0.5 bar while the vacuum in the outer bag reaches a pressure of 0.96 bar. The 0.5 bar vacuum in the inner vacuum chamber will not substantially debulk the preform and it will not maintain the preform as substantially debulked during resin infusion. As in Lang, when the outer vacuum chamber vacuum reaches 0.96 bar, the high inner chamber pressure will push the inner bag away from the preform and towards the outer vacuum chamber. This is bag relaxation of the inner bag. Once the RIFT inner bag relaxes, the preform will begin to swell. Any preform swelling increases preform size away from its most debulked state. Bag relaxation prevents the preform from being substantially debulked and remaining substantially debulked during resin infusion.

After evacuation of the RIFT vacuum chambers, resin infusion can begin. As the bag has been relaxed away from the preform, as explained in the proceeding paragraph, the resin wave front will also push the inner bag away from the preform thus increasing bag relaxation. Resin infusion into the swelling preform will increase preform swelling. Any preform swelling increases preform size away from its most debulked state. Bag relaxation prevents the preform from being substantially debulked and remaining substantially debulked during resin infusion.

Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion

on how to combine or modify the references, with the combination or modification being sufficient to render Claim 50 obvious to one of ordinary skill in the art. Therefore, it is respectfully submitted that Claim 50 is patentable over the Lang and Cochran patents or the RIFT paper and is in a condition for allowance.

Claims 51-53 depend from Claim 50. For reasons analogous to those presented above in relation to Claim 50, it is respectfully submitted that each of the cited references, either alone or in combination, fails to teach or suggest the respective methods of Claims 51-53.

Claim 54

Claim 54 recites a method for infusing with resin a preform disposed on a mold. Among other steps, Claim 54 states:

evacuating the vacuum chambers such that the bags provide a caul effect with respect to the preform; and

infusing resin into the preform when the vacuum chambers are evacuated <u>such that the inner bag is substantially prevented from relaxing behind a wave front of resin when resin is infused into the perform</u>.

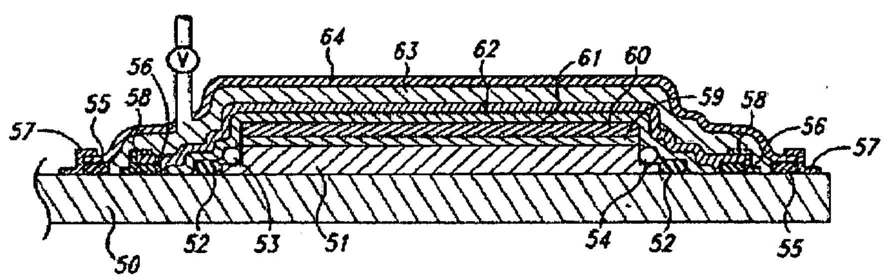


Fig. 2

Support for the amendment to Claim 54 can be found in the specification and in the following exemplary passage, but support relied upon is not limited to this section:

> [0011] Our preferred double bag vacuum infusion process circumvents the Seemann (single bag) problems in that the inner and outer vacuum bags independently control the resin feed. …. With this approach, **the bag is never able to relax behind the wave front** and the resulting composites have higher fiber volumes on average (with more precise control) and have uniform thickness with constant thickness preforms. ….

The Final Office Action dated August 20, 2007 states about Lang on page 10:

> -… Lang does not explicitly teach a "caul effect", however, it is submitted that in view of the **evacuation of the chamber surrounding the preform** it would have been obvious that the chamber **would compress such that it would obviously provide a caul effect.**

Yet again it is respectfully submitted that this characterization of the Lang patent is erroneous.

Lang et al "… positions a spacer system (191) onto said inner bag, placing an outer vacuum bag (189) onto said spacer system (191) to form a second vacuum chamber…" as stated by the Examiner in the office action dated July 11, 2006 and shown in Figures 9-12 of Lang et al. (Figure 10 above). During evacuation of both the inner and the outer vacuum chambers, a higher pressure in the inner vacuum chamber presses the inner bag against spacer system (191) and away from the preform. The inner bag forms channels or pathways for the resin to move across the top of the preform during resin infusion. **The spacer system (191) and the higher pressure in the inner vacuum chamber prevent the first vacuum chamber from collapsing substantially against the preform.** Pushing the inner bag away from the preform to form channels for resin movement on top of the preform is bag relaxation away from the preform. **When the inner bag has relaxed away from the preform, it cannot provide a "caul effect" to the preform.**

The Examiner notes that the resin itself also pushes the inner bag away from the preform when he states that "the resin presses the flexible membrane open to create channels (5:52-56). In maintaining a vacuum on both sides of a flexible membrane such that the membrane does not deform, it would have been **obvious to use a second vacuum pressure equal to the first vacuum pressure during resin injection …"** **If the resin can push the inner bag away from the preform to form resin channels when the pressure in both bags are equal, the resin can certainly push the inner bag away from the preform when the higher inner chamber**

pressure helps the pushing as explained in the paragraph above. When the resin wave front pushes the inner bag away from the preform during resin infusion, it creates bag relaxation. **When the inner bag has relaxed away from the preform, it cannot provide a "caul effect" to the preform.**

Figure 10 shows an individual spacer 191 and an inter-connecting link 195 located between outer bag 189 and inner bag 185. **The spacer system (191) located between the** outer bag 189 and inner bag 185 **prevents the second vacuum chamber from collapsing substantially against the first vacuum chamber.**

Bag relaxation may lead to mark off on the surface of the cured preform which is contrary to the teaching of Waldrop. In paragraph 17, Waldrop states, "bag side roughness and mark off is a common problem experienced with prepreg processing and bag liquid molding processes. Cauls and intensifiers are often used on the bag side of the laminate to improve surface finish."

On page 519 of RIFT, an embodiment "using a double vacuum bag" is disclosed. "DSM have also introduced a method using a double vacuum bag. Low vacuum (0.1) is initially applied to the inner bag to lightly compress the reinforcement. At this stage the fabric is manually pressed into corners of the mould. Vacuum is then raised to 0.5 bar after which the outer bag is put in place. An even distribution of vacuum has to be achieved between the films: a breather layer (synthetic tissue is used so that the resin front can be seen) is laid between each film. Vacuum between the films is then increased to 0.96 bar (gauge pressure). The increase in vacuum pressure between the films removes the danger of air into the tool through the bag. During laminate filling the inner vacuum is turned off, with resin inlets and outlets plugged. The outer bag vacuum is maintained in order to consolidate the laminate until the resin has cured."

In RIFT, the vacuum in the inner vacuum chamber reaches a maximum of 0.5 bar while the vacuum in the outer bag reaches a pressure of 0.96 bar. **Therefore the pressure in the inner bag is greater than the pressure in the outer bag.** The inner vacuum bag will be pushed up towards the outer vacuum bag by the higher pressure in the inner vacuum chamber. This situation is similar to what is shown in Lang in Fig. 10. The pushing of the inner bag away from

the preform is known as bag relaxation. **When RIFT evacuates the outer chamber to 0.96 bar and then infuses resin, the combination of the greater pressure in the inner bag and the resin wave front during infusion pushes the inner bag away from the preform. When the inner bag has relaxed away from the preform, it cannot provide a "caul effect" to the preform.**

RIFT does not describe evacuating the vacuum chambers such that the outer vacuum chamber has a pressure greater than a pressure in the inner vacuum chamber such that the inner bag is substantially prevented from relaxing behind a wave front of resin when resin is infused into the perform as stated in claim 46.

RIFT has a breather located between the outer bag and inner bag. This breather prevents the second vacuum chamber from collapsing substantially against the first vacuum chamber.

Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been established by the Patent Office because the cited references do not provide any suggestion on how to combine or modify the references, with the combination or modification being sufficient to render the method of Claim 54 obvious to one of ordinary skill in the art. Therefore, it is respectfully submitted that Claim 54 is patentable over Lang and RIFT and is in a condition for allowance.

Claims 55-57 depend from Claim 54. For reasons analogous to those presented above in relation to Claim 54, it is respectfully submitted that each of the cited references, either alone or in combination, fails to teach or suggest the respective methods of Claims 55-57.

CONCLUSION

In view of the foregoing, and the remarks presented above, it is respectfully submitted that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the

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present application, the Examiner is encouraged to contact the undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 18-1730.

Respectfully submitted,

Brett Halperin

Brett Halperin
Registration No. 46,478
(562) 797-9013